

## THE PROGRESS OF THE ISTHMIAN CANAL.

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*(Read April 19, 1907.)*

It was the privilege of the writer to be one of a party which visited the Canal Zone, as it is termed, on March 1 and 2 last. The expedition was organized for an inspection of the conditions and progress of the work there going on. In view of the conflicting accounts which from time to time had been published, plans for a visit and personal inspection of the actual conditions were matured last fall.

The party was composed of about ninety men, members of the Commercial Clubs of Boston, Chicago, Cincinnati and St. Louis, many of whom are at the head of large enterprises of varied character in the cities mentioned; often closely connected with public activities. There were presidents and other officers of railway, express, power and other public service corporations, managers of mills and varied manufacturers, heads of commercial enterprises, banking institutions, fire insurance, and a few professional men such as lawyers and engineers. The mayor of the city of St. Louis and ex-Governor Francis, the president of the Louisiana Purchase Exposition were of the party.

A steamer of the Hamburg-American Line, specially fitted up for travel in the tropics, and chartered for the trip, sailed from New York on February 18 with about twenty passengers, mainly the Boston contingent, and reached Charleston, S. C., two days later, where the members from the western cities embarked. After a direct run to the island of St. Thomas, of the Danish West Indies, and a brief visit to Porto Rico, the ship left the southern port of the island, Ponce, for Colon. During the run about nine hundred miles southwesterly from Porto Rico, much time was given to securing an effective organization of the passengers, so as to obtain as much information as possible in a short time. To this end there were formed eight committees each composed of from ten to twelve

men. Specific subjects were selected, one for each committee, subjects which related to the sanitation, plan of administration, food and commissary work, housing, social and labor conditions, effects of climate on Americans, efficiency of plant and progress of work. Those serving on any particular committee were chosen in accordance with their special aptitude or training in the subjects with which it was to deal. The chairmanship of one of these divisions was entrusted to the present writer. Before the arrival at Colon, the organization was in good working shape, and in some instances, to assist the work, a further division into sub-committees was made.

Wireless communication with Colon permitted requests to be forwarded to the effect that upon the arrival there, the canal officials in charge of the particular phases of the work might meet the respective committees prepared to furnish such information as might be sought by them. To render this effective, the committee had, beforehand, formulated a scheme of inquiry to be followed if possible, upon arrival at the Canal Zone.

In the special message of the President to Congress on December 17, 1906, concerning the Panama Canal, which followed upon his personal visit to the isthmus, he referred to the expected visit of the commercial clubs, and promised that every facility would be given them "to see all that is to be seen in the work which the government is doing." He says further: "Such interest as a visit like this would indicate, will have a good effect upon the men who are doing the work, on one hand, while, on the other, it will offer as witnesses of the exact conditions men whose experience as business men, and whose impartiality, will make the result of their observations of value to the country as a whole."

The journey from Porto Rico to Colon was through the comparatively calm and warm tropical sea, swarming with flying fish, which rose in flocks as the steamer moved among them. The weather conditions were good, and the temperature of the air, both night and day, owing to the prevalent trade winds, was not warm enough to cause any discomfort. A special train on the Panama Railroad had been arranged for to meet the body on its arrival at Colon, which took place on the morning of March 1. Each car

of this train on the journey across the isthmus, was occupied by two of the committees, eight in all, and with them were the officials of the Canal Zone having special charge of the subjects upon which the particular committee was to seek information. It is fair to say that this was in all cases given freely and courteously with the utmost frankness, calculated to elicit the fullest interest and sympathy.

After leaving Colon on the trip southeasterly to Panama, a number of stops were made at various points along the route of the canal. At Christobal near Colon an inspection of docks, machine shops and other shops for repair and construction, was made. Here the equipment was found to be modern and well adapted to the work, and there seemed to be a good force of skilled machinists and other workmen, among whom were many Swedes. Similar large shops exist at other points, notably at Empire not far from Culebra.

The working forces seemed to be in excellent physical condition. From Christobal there runs for several miles the canal dredged by the French. Owing to change of location this does not become part of the accepted plans, and will be used only for transporting materials and machinery to the vicinity of Gatun, about seven miles from Colon, the site of the proposed great dam known as the Gatun dam. Leaving the train at this point the hill at the east end of the proposed dam was climbed and the site of the great canal locks to be constructed here was reached. The weather conditions were so good that even in the tropical sun no discomfort was experienced even in briskly walking up hill. This was due to the cool trade wind coming from the east.

From the Gatun Hills, looking across to the farther hills where the other end of the dam will rest, one begins to acquire an impressive sense of the magnitude of the whole enterprise, such as no amount of reading or examination of maps or plans can give. Here several large steam shovels, and construction trains were actively in service, excavating at the lock sites and building part of the embankment of the dam itself.

There has been much discussion of the subject of a canal with locks as against a true sea-level waterway, the latter project being

favored by many of the foreign engineers, while the decision of Congress to build a lock canal was made, as is well known, in accordance with the recommendation of the American engineers. The writer does not profess to be able to judge between these two schemes. It would be presumption for one who, though much of his work has been engineering of a special kind, is not experienced in civil engineering, much less in such matters as have divided the opinions of many of the foremost engineers of the time, who have been called upon to devote a long period to their consideration. All that is attempted to be recorded here is an impression; which may not be worth much. Still it is an impression. The writer had previously in common with many others, conceived the idea that it would be a mistake to build any other than a sea-level canal, but upon arriving at the site of the Gatun dam, and witnessing the conditions, this idea soon gave place to a feeling that the lock canal project was probably a correct solution. Nothing has since been learned tending to change this impression, which, in fact, was more and more confirmed or strengthened as the further inspection of the work in the zone was pursued.

The problem of the Chagres River floods which was so serious in the case of a sea-level canal solves itself in the lock canal, with the dam at Gatun. This structure when completed will impound the river water even in heavy floods and form above the dam a great fresh-water lake of about one hundred and ten square miles in area, the level of which will be about 85 feet above the sea. For about twenty miles ships will be able to steam at good speed in this elevated lake and make up for time lost in passing the locks, so that the actual time of passage through the canal may not differ greatly from that which would have been needed in the case of a sea-level construction. On the right of the proposed dam, as one faces Colon, was seen the site of the three great locks, which will be built in flight and in duplicate. In fact, the work of excavating for them had been begun, as before stated. The locks being in duplicate will permit simultaneous passage of ships both ways, or up and down. They will be of size enough to accommodate, with considerable margin, the largest vessels in existence; greatest length, breadth of beam and draught.

The dam itself is to be in reality a great earth bank spanning a distance of about 7,700 feet between the hills, and it will be not less than 2,600 feet wide at its base, tapering to a crest of about 100 feet wide and this crest will be considerably over 100 feet above sea level, with a great concrete spillway near its center. At the site of the dam, careful rock soundings have been made, a work which was still going on, and samples brought up from various depths were examined. These show that at distances from the present surface of the ground, varying from a few inches to 200 feet or more, a solid compact rock, called indurated clay, sometimes including fossil marine shells, exist; slaty gray in color. The engineers seem so far to be satisfied with the nature of the foundation on which the great dam will rest, in view of its great width at the base, which is regarded as giving ample stability.

The material required for the construction of the dam will be largely that brought down from the heavy cutting at Obispo and Culebra, though at the time of the visit of the writer, none of this was being used at the dam, as the transportation facilities had not been completely arranged. The problem is one of transportation and the conditions will be much improved when the double tracking of the Panama Railroad is completed. This with the exception of nine miles, had already been done. Besides this, many large modern locomotives and construction cars are soon to be added to the plant, already so extensive. In the meantime, some of the small capacity dumping cars left by the French Company are being used, as are also some of the numerous small French locomotives, found along the line. The parts of some twenty-five or thirty new locomotives were seen on flat cars, awaiting assembly at the shops in the zone.

Leaving Gatun, the railroad follows up the Chagres River at a varying distance therefrom, through a country which is at first but slightly hilly, but which becomes more and more rolling. It is for the most part covered with a thick growth of tropical jungle, with some cleared spaces. Here and there along the route are small groups of huts or shacks inhabited by negroes; remains of a mode of life which will gradually be eliminated from the zone. Often the views from the train are most picturesque, as river vistas and

stretches of country come into view bordered or covered by the bold and intensely colored foliage of tropical plants. At last the river valley leads off to the east and the train moves toward the beginnings of the deep cutting at the divide.

At Bas Obispo over thirty miles from Colon is the great rock cut and since the general course of the canal is southeast, this cut is about five miles to the northwest of the celebrated Culebra cut, where the greater part of the excavating work needed is now done and has still to be done in the future. From the Gatun dam there will be about thirteen miles of flooded river valley deep enough for ships of the greatest draught without dredging or excavation, but for the rest of the distance toward Bas Obispo material in increasing depth will need to be removed.

The French left the level of the cut at Bas Obispo at about 100 feet elevation, which has since been cut down by the Americans to 74 feet up to March 1. To satisfy the condition of an 85-foot water level some thirty-four feet more in depth will be removed. The deepest cutting done and yet to be done, is at the true divide or Culebra cut. At Bas Obispo, but more especially at Culebra, are the evidences of the great amount of work which had already been done by the French. In fact, the real work of building the canal is here. To complete this section of the canal, a length of about nine and one half miles, will require the removal of about 50,000,000 of cubic yards of rock and earth in addition to that which has been taken out hitherto. At the station called Empire, between Bas Obispo and Culebra, a stop was made for viewing the shops located there, and to allow a glimpse of some of the discarded French machinery to be had. Here rows of beautifully built, but according to present standards, small-sized locomotives of French make are found partly overgrown with vines. The workmanship of these and other remains of French plant, so bountifully strewn the canal route, is highly esteemed by the present engineers. The fault of small size or capacity, it is only just to say, would have characterized such machinery in general at a time twenty or more years back. A considerable number of these French engines are actually in service now. Their refined construction is sufficiently indicated by the fact that they have copper fire boxes and white metal fire tubes.

On the way from Bas Obispo to Culebra the evidences of great activity were numerous. Stone crushers, roundhouses, coal chutes, air compressing plants for drills and the present dumping grounds were seen in succession. Camp Elliott, with a body of U. S. marines, the auditing and disbursing officers of the Isthmian Canal Commission, the Circuit Court District No. 2, the officers of the engineer of the Culebra Division, etc., were passed.

Near the great Culebra cut was found the apparently flourishing town of Culebra. Here are situated the administration offices and the headquarters of the chief engineer, Mr. John F. Stevens, who here joined the visiting party. The great Culebra cut was seen; not very different in aspect from the time when the task was given up by the French company. Here as at Bas Obispo, work was in active progress, huge steam shovels being used, some of which were capable of lifting at one time as much as five cubic yards of broken rock or earth, after it had been loosened by explosives, and depositing it upon the construction cars in long trains, in which it was hauled away and dumped. The tracks on the dumping grounds, as well as in the area of excavation, are required to be quickly moved or relocated; a necessity which has led to the devising, by one of the engineers, of a plan for quickly shifting portions of the line sideways to a distance of nine feet without disjuncting it or loosening it from the ties. The town of Culebra, like the other settlements in the zone, is remarkably clean. Much care has been given to the proper placing and construction of the buildings. Here in a large hotel restaurant the visiting party partook of a midday meal which was well prepared and served. There was no annoyance from flies, mosquitoes, or other insect pests. In fact, the writer believes it to have been the general experience that no mosquitoes were encountered anywhere in the Canal Zone. It may possibly have been the season when they are naturally scarce or absent, or the absence may have been due to preventive measures. While traversing the Culebra cut in flat cars provided with improvised seats or benches, men belonging to the mosquito brigade were noticed sprinkling oil on small pools or sluggish streams within the cut. The sanitation of the zone will, however, be alluded to further on.

Within the Culebra cut the highest point of the divide is now about 167 feet above sea level, having been originally or before any cut was made about 333 feet. The French cut down 160 feet. At this point the additional cutting required to complete the canal is about 127 feet. A total depth of cut of about 290 feet will thus be needed. A sea level canal would have made this 375 feet. Naturally the amount of earth to be removed increases with the depth because the greater depth requires much wider cutting to provide reasonable slopes safe from landslips, and the length of the excavation is likewise greatly extended. The money expenditure for the sea level project as well as the time needed would have been several fold more than for the lock or present plan.

Explosives are used both in the rock at Obispo and in the compact earth at Culebra and in January last, it is reported, about eleven miles in total length of holes were drilled for blasting. Beyond Culebra the site of the first lock on the Pacific side, which is known as the Pedro Miguel lock, was soon reached. It is to be a duplicate lock with a single drop from the 85-foot level, of about thirty feet or a little less.

At its foot another fresh-water lake at 55 feet above sea-level will be made by dams at a place called La Boca, about two miles from the city of Panama and to the west thereof. The area of this lake will be upwards of ten square miles. Alongside of the La Boca dam will be located the Sosa locks at Sosa hill. These will be in duplicate and in a flight of two with level differences of about 27 feet or more, or 55 feet for the two locks. Inasmuch, however, as the maximum tides at Panama are as great as 24 feet, provision for variation in the lock levels is made in accordance therewith. At Colon the tides are a little more than 2 feet. From the foot of these locks at Sosa a channel is to be dredged straight out to sea in the Bay of Panama, the locks at Gatun being similarly reached from the Atlantic side by a straight channel out to sea in Limon Bay, upon which bay Colon is situated. Practically none of this work of dredging is yet done.

Since the present plans follow a different route from that adopted by the French, the dredging accomplished by them is not now of use. The city of Panama is about two miles to the east of the



new location of the sea channel from the Sosa locks or La Boca Dam, and it is just outside the ceded territory known as the Canal Zone. It has, however, recently been given clean and well-paved streets. It possesses much of the picturesqueness of the old Spanish settlements.

On the edge of the zone at Panama, the United States government has built a large modern hotel, suited in construction to the tropics. It is on an elevated site overlooking the city and the Bay of Panama. This hotel is used by officials and engineers of the Canal Zone and their families. Here at the Tivoli, as it is called, an evening reception and dinner was tendered to the administrative force engaged in the zone by the party of visitors, at which were present the President of the Republic of Panama, the U. S. Minister to Panama, the Chief Engineer, Mr. Stevens, and others. Although Panama is but nine degrees north of the equator, the weather was all that could be desired, a clear sky, a fair breeze, and moderate temperature. The full moon rose over the bay, which happens to extend eastwardly from the city, so far as to give the effect of an open sea. Thus the Pacific ocean is to the east of Panama, to all appearances. After a comfortable night at the Tivoli, a detailed inspection was made at the site of the proposed dams at La Boca and that of the locks, there. The work of construction is soon to proceed. On the return trip to Colon a stop was made for a visit of inspection to the great storehouses at Mount Hope, formerly known as Monkey Hill, a few miles from Colon. Here there can be found, properly classified and arranged and subject to requisition, supplies and equipment of nearly all kinds outside of food; an epitome of all human needs; the product of innumerable factories of the most varied description. A catalogue of the things stored here would fill volumes. Here also were seen large quantities of stores in the form of iron and steel bars and plate left over from the French regime and largely capable of utilization in the present work.

While all along the canal route there exists an immense amount of discarded machinery known as French scrap, it would not pay at present to attempt to gather it up; the transportation facilities at command being already taxed to the utmost in the legitimate work

of construction and supply. Notwithstanding this fact, a large part of the cast iron used in the foundries in the zone is taken from the French scrap. It is possible that the light rails of the railways used by the French in construction, may become available as reënforcing material for concrete to be used in locks, or the like. Doubtless in time an opportunity may arise for collecting this valuable debris, consisting usually of high grade metal.

The question of health on the Isthmus of Panama is of vital importance in the prosecution of the work. In times past, the experience of the French company in regard to the spread of disease, and in the consequent mortality, was so bad that the region became a by-word for unhealthfulness and danger to life. This was, however, before modern methods of sanitation were known or practiced; and before the modes of transmission of the germs of malaria, yellow fever and severe intestinal disorders had become known. As soon as certain species of mosquito were known to be intermediate hosts for the organisms to which malaria and yellow fever are due, the problem of canal construction was seen to be in a large degree dependent on getting rid of these culture-charged insect pests. Throughout the Canal Zone the evidences of success in this direction are palpable. Under the direction of Colonel Gorgas, who has charge of the sanitation of the zone, it has been rendered much safer than many localities in our southern states. What menace there is, is not within the zone, but arises from the possibility of introduction from the outside. A most admirable system has been put into practice, including medical inspection, distribution of medicine, drainage, fumigation, mosquito brigades and general sanitation, such as abatement of nuisances, removal of offal and garbage, clearing of land, burning of rank vegetation, etc. The whole is a splendid example of the application of scientific principles which might well be copied in many places. The first evidences were found at Colon in the filling in of low ground, the paving of streets and improved drainage. Again at Gatun, the tropical jungle had been cleared away almost to bare ground, especially around the habitations and where men were at work. Drainage channels had also been dug. While a few tent houses were still in use there, these were soon to be replaced by a type of dwelling now usual in the

zone, and which permits excellent sanitation and protection from mosquito infection.

These buildings are of wood, well painted, supported on posts or on pillars of concrete so as to be clear of the ground. They are of one, two or three stories in height with wide piazzas on each floor, sometimes all round, securing coolness and shade. The piazzas are screened with brass wire netting and in the sleeping apartments the usual mosquito netting is a supplemental protection. The habitations are situated on high ground, as on hills or hillsides, which can readily be kept cleared and free from pools of water. Underground drainage is provided where it is conducive to the general result.

Too much praise cannot be given to the work which has already been accomplished. The present remarkable healthfulness, the fruit of this intelligent system, is seen in the low mortality disclosed by the recent records of the zone. After all, there is no more important influence to be reckoned with in the success of the construction work, than the health and vigor of the men engaged in it. Add to the measures of sanitation, the provision of proper food and good water, together with prevention of abuse of alcoholic drinks, and it would seem that the problem of labor, even white labor, on the isthmus is solved.

It is curious to note the opinion of the men in charge as to the value of the different classes of labor of which use has been, or is now made. Negro labor, largely from Jamaica and other West India islands is rated much below white labor and the pay accorded is accordingly less. White labor from northern provinces of Spain is reported as most satisfactory and Italian labor is also looked upon with favor. It was found necessary not to entrust the negro with the choice of his own diet, as this resulted in his using only watery tropical fruits, or innutritious yams, etc., rendering it impossible for him to sustain effort, owing to actual lack of nourishment. As a result, three meals are furnished at thirty cents a day and these contain a proper balance of nitrogenous and carbohydrate constituents. He is compelled in this way to receive due nourishment and

it is said that the wisdom of this arrangement is easily seen in the work accomplished.

In Colonel Gorgas's February report to the Department of Health of the Isthmian Canal Commission, in relation to the screening of houses, occur statements to show how little the efforts in their behalf are appreciated by the negro employes. He says: "Unfortunately for the colored employes, as well as for others, the metallic screening on the buildings occupied by them is roughly treated and abused by them and has to be protected and watched." Again: "The white European laborer works much harder and more continuously than the colored employe. Aside from the clerical force, the white employe is exposed to the same conditions as the colored employes. . . . The sleeping quarters of the colored laborer and those of the white laborer are similar in every respect."

The President in his message before mentioned has referred to the fact that the colored laborer after having been brought to the zone at government expense, frequently escapes from control and resolves himself into a loafer at Colon or a jungle dweller occupying unsanitary unscreened shacks. This constitutes a most undesirable element, and even a menace from the ease of propagation of disease among such a class. Hence there is an increasing tendency to utilize desirable white labor in greater amount, and this may eventually result in a much increased proportion of whites to blacks in the zone, a proportion which has been approximately one to four hitherto.

Concerning the actual work of canal construction already accomplished under the present regime it may be said that only within the past few months has a real beginning been made. There was needed a season of preparation, arranging for sanitation, organizing the working forces, constructing buildings, storehouses, gathering supplies, and machinery. This period may now be said to have been succeeded by the opening of another one to be devoted to the shifting of huge volumes of earth and rock; the real construction period, the work accomplished in which depends directly on the maintenance of the conditions which have been so far established, and the large cost of which should be balanced by the reduction of time and expense for the actual construction of the canal proper.

There were, on March 1, according to information, between 25,000 and 30,000 men at work on the isthmus and the amount of material removed in cubic yards in the month preceding had been exceeded, so that it was thought that the figure of 1,000,000 cubic yards per month could soon be maintained.

The work itself was found to be proceeding steadily, backed by energy and earnestness of purpose of the men who were in charge. The general impression gained by the visiting body was that, with an organization such as existed under Mr. Stevens and with the improved living conditions enabling suitable labor to be secured and retained, and with modern machinery of great capacity, the progress in building the canal can be expected to continue steadily and perhaps further improvements in detail will be made. Everything depends upon maintaining an efficient organization which shall preserve the high working standard which has done so much within the past year. There is need of rational diversion and entertainment for the men employed. Schools have already been established for the children of the settlements, and it is believed are under the care of competent teachers. Athletic exercises and games, such as baseball, are resorted to for amusement and the climate is not such as to forbid moderate exertion out of doors even as pastime. While the annual rainfall at Colon is very high, ranging upto about 140 inches per annum, at Panama on the other hand it is said to be only about one third as great or about what we have along the Atlantic seaboard.

On leaving Colon for the return journey, the eight committees before referred to, utilized some of the time in preparing reports which were submitted for discussion to the whole body at meetings held for that purpose. The final result was the preparation and adoption of a combined report commending the work witnessed at the zone and the conditions which rendered it possible.

It may be too early to make predictions, for there may arise at any time serious obstacles and setbacks, but if conditions continue as favorable as they now appear to be, the completion of the great work, so important especially to the United States, should be possible within eight or at most ten years. The result of the inspec-

tion by the organized body of ninety members of the Commercial Club party is in reality an endorsement of the work of the Isthmian Canal Commission and a corroboration of the President's report to Congress after his memorable visit to the isthmus and remarkable practical examination of the work. It is a work in which every citizen should feel an interest.